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ARSET
Applied Remote Sensing Training
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Satellite Based Fire Products: Methods, Data Access, and Applications

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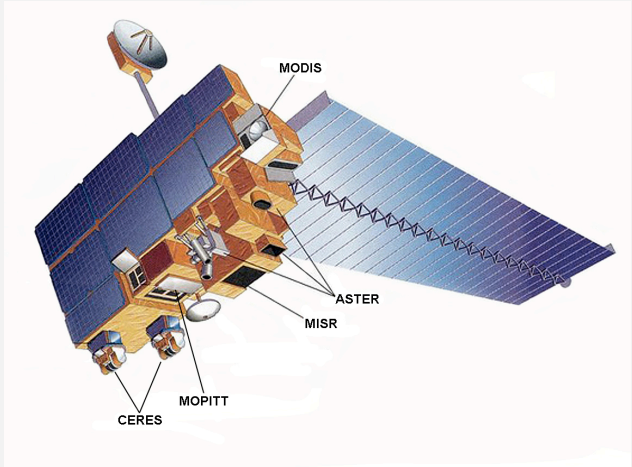
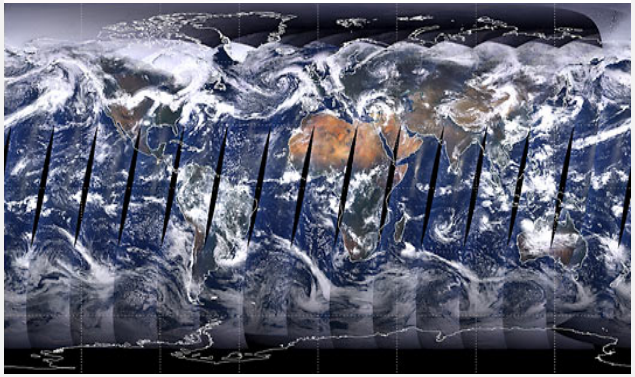
Satellite Remote Sensing of Air Quality

September 19-21, 2017
University of California, Riverside

MODIS

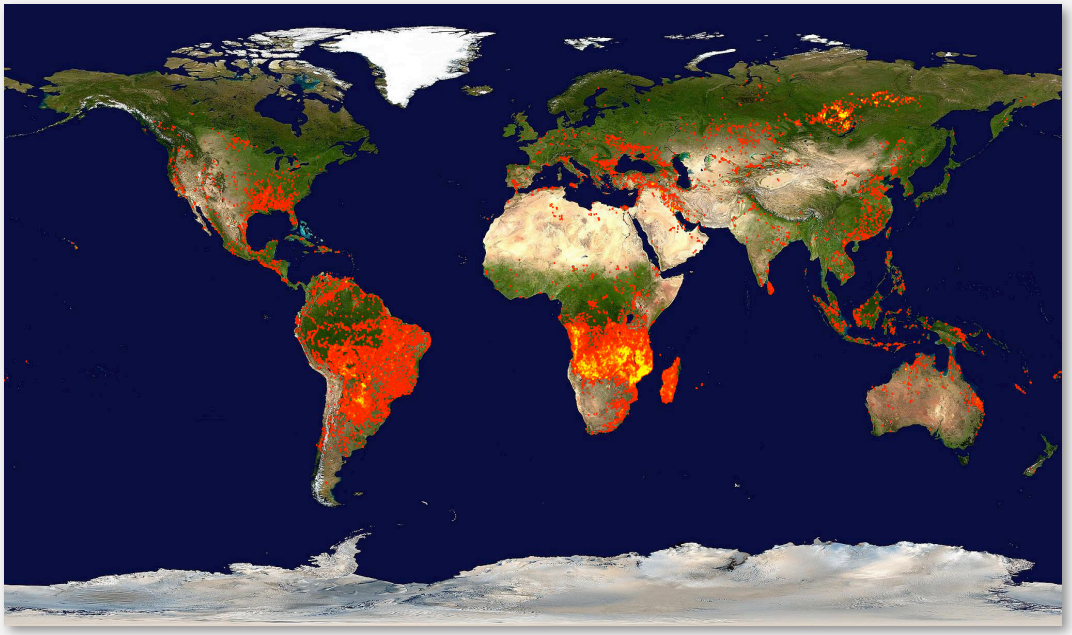
- Spatial Resolution
  - 250 m, 500 m, 1 km
- Temporal Resolution
  - Daily, 8 day, 16 day, monthly, quarterly, yearly
  - 2000–present
- Data Format
  - Hierarchal data format – Earth Observing System Format (HDF–EO8)
- Spectral Coverage
  - 36 bands (major bands include red, blue, IR, NIR, MIR)
    - Bands 1-2: 250 m
    - Bands 3-7: 500 m
    - Bands 8-36: 1000 m





MODIS Fire Products

- Near Real-Time (NRT) thermal anomalies and fire locations
- Provides snapshots of active burning fires and burned areas
- The Active Fire product delivers actively burning locations on a daily basis at 1 km resolution (additional 8 day and monthly products)

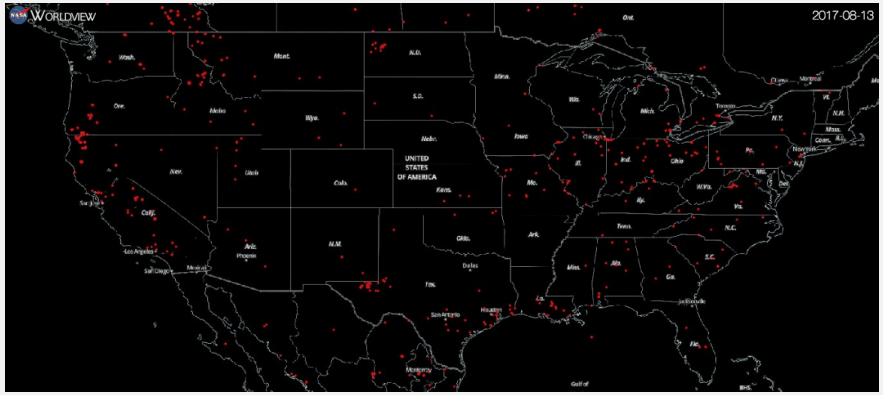


Global Fire Map
(September 17 – 26, 2016)

Colors range from red, where the fire count is low, to yellow where the number of fires is large

MODIS Thermal Anomalies Algorithm

- MODIS Fire Detection:
  - 1 km pixel flagged as containing one or more fires
  - can also detect volcanic signatures
- Significant increase in absolute radiance at 4 μm (band 22) and 11 μm (band 31)
  - cloud masks applied
  - VIIRS active fire detection algorithm is similar



VIIRS fire detections, NASA Worldview

MODIS Fire Detection Algorithm

http://modis-fire.umd.edu/files/atbd_mod14.pdf

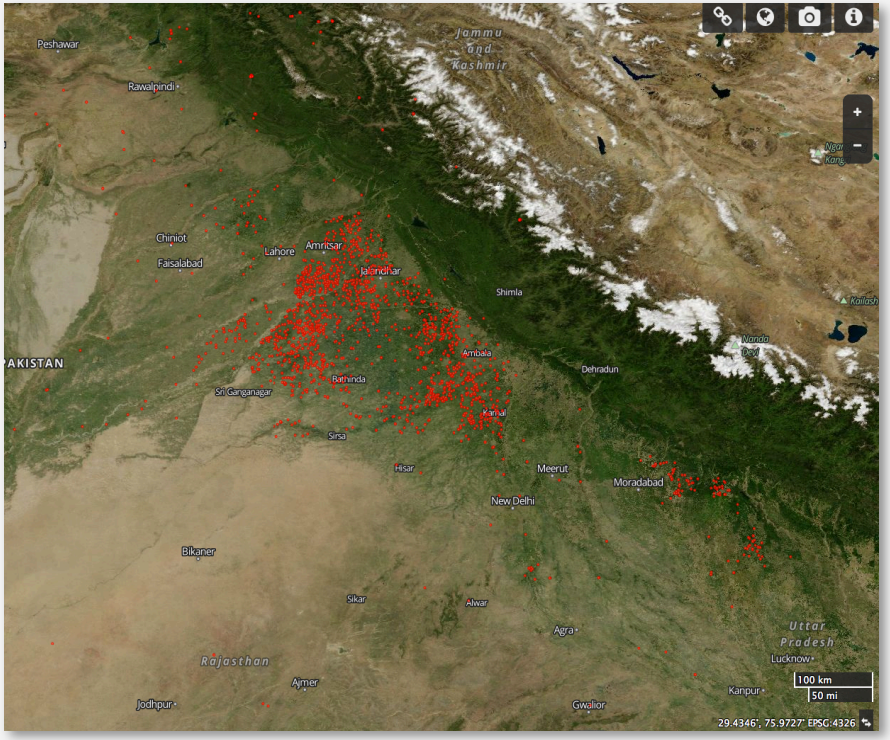
Table 2: MODIS channels used for active-fire detection and characterization.

Channel	Central wavelength (μm)	Purpose
1	0.65	Sun glint and coastal false alarm rejection; cloud masking.
2	0.86	Bright surface, sun glint, and coastal false alarm rejection; cloud masking.
7	2.1	Sun glint and coastal false alarm rejection.
21	3.96	High-range channel for fire detection and characterization.
22	3.96	Low-range channel for fire detection and characterization.
31	11.0	Fire detection, cloud masking.
32	12.0	Cloud masking.

- Potential fire pixel identified
  - BT4 > 310 K
  - BT4 – BT11 > 10 K
  - 0.86 reflectance < 0.3
- Otherwise flagged as non-fire pixel

MODIS Thermal Anomalies Algorithm

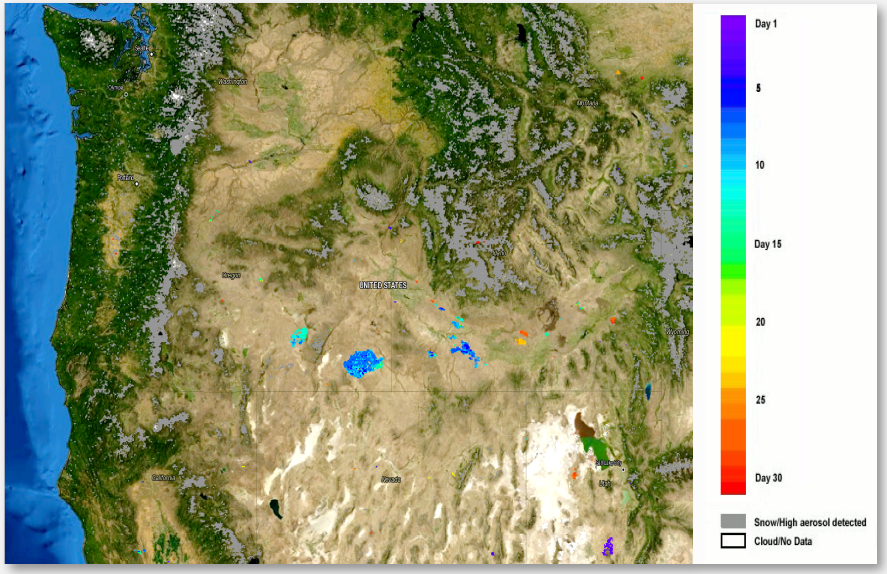
- Limitations
  - False positives: small forest clearings (bare soil)
  - Large fire omissions due thick smoke
- Collection 6 (most recent) improves upon these errors
  - Global commission error of 1.2%



MODIS fire detections, NASA Worldview

MODIS Land Products: Burned Area (MCD64A1)

- The combined Terra & Aqua MODIS Burned Area Product is a monthly gridded 500m product
- MODIS detects the approximate date of burning at 500m resolution
- Maps include the spatial extent of recent fires
- For more information: http://modis-fire.umd.edu



This image shows the extent of the Long Draw fire that occurred in southeastern Oregon
The colors represent the approximate day of the burning from July 8 (start of fire) to July 12, 2012 (end of fire)

Where to Obtain MODIS Products

Land Process Distributed Active Archive (LPDAAC) http://lpdaac.usgs.gov/

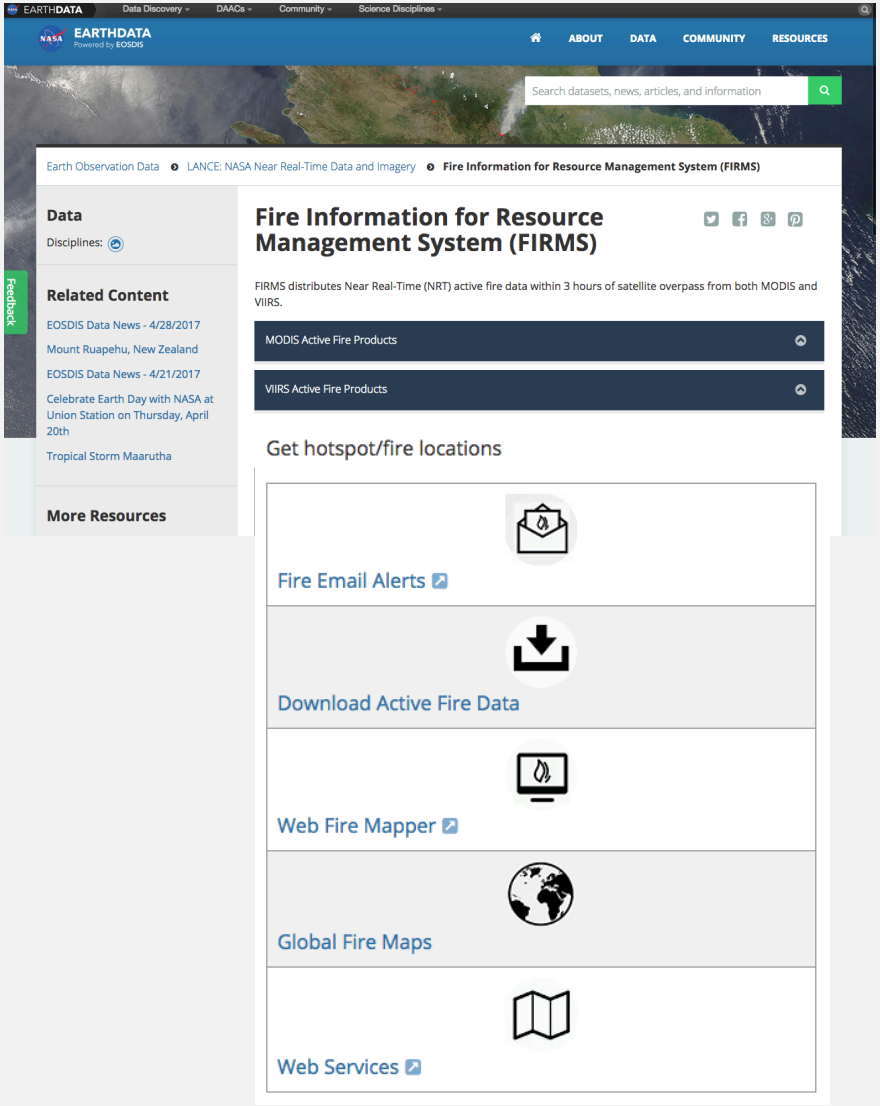
ECHO Reverb: http://reverb.echo.nasa.gov

Worldview: http://worldview.earthdata.nasa.gov

Fire Information for Resource Management System: http://earthdata.nasa.gov/earth-observation-data/near-real-time/firms

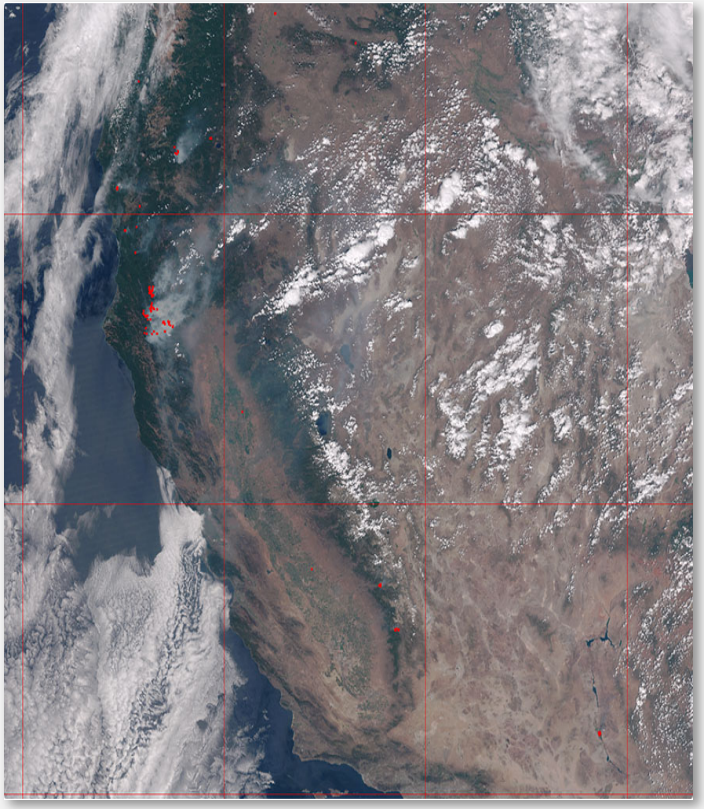
Fire Information for Resource Management System (FIRMS)

- Near real-time (NRT) active fire data within 3 hrs of satellite overpass
- Global MODIS and VIIRS hotspots, fire locations, and burned area images
- Historical data available
- Available in:
  - Email alerts
  - GIS-friendly file format
  - Visualization in Web Fire Mapper or Worldview



VIIRS Active Fire Product

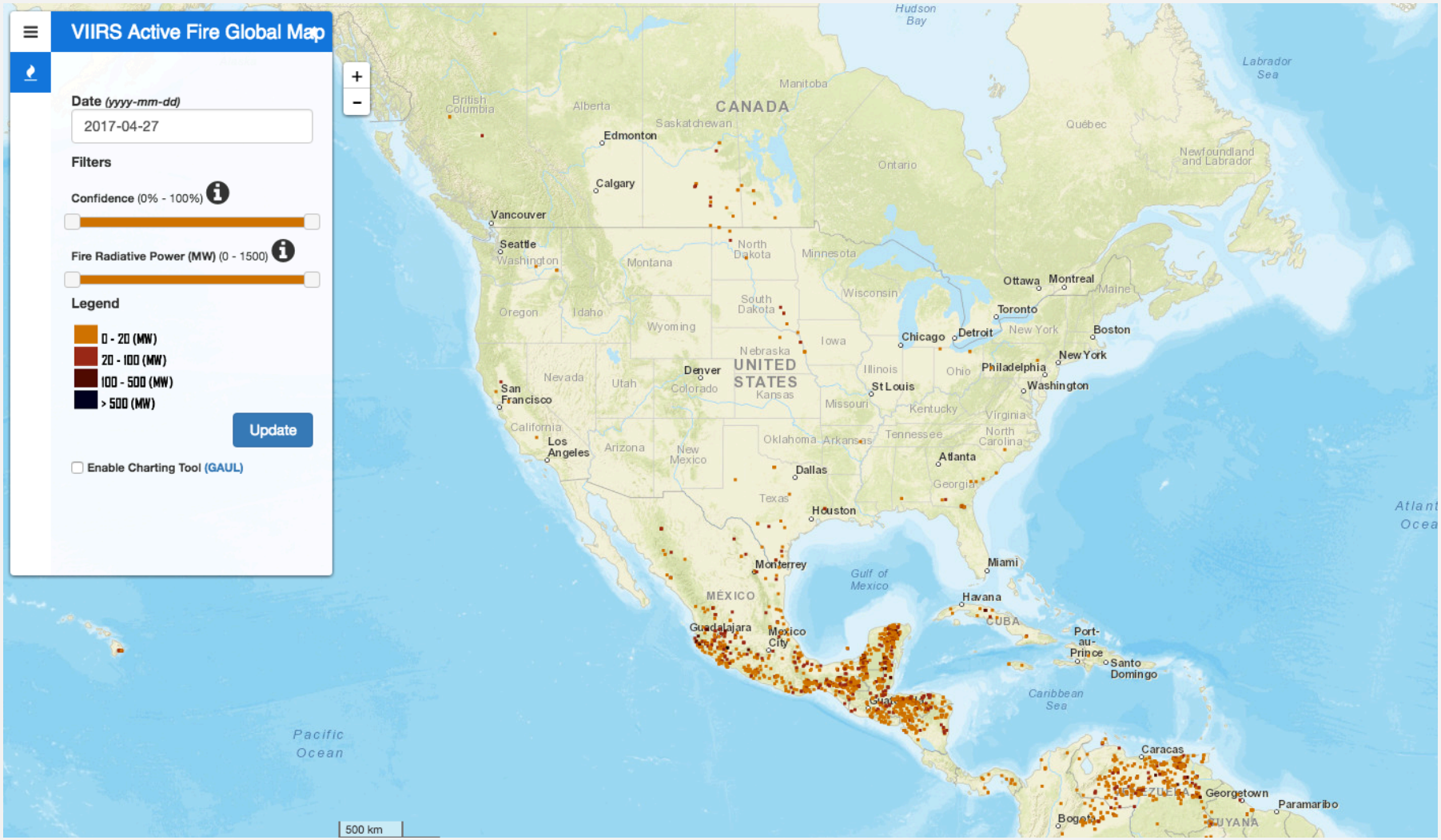
- Released October 22, 2012
- Spatial resolution:
  - 750 m (M-band)
  - 375 m (I-band)
- Data still preliminary and continually undergo evaluation & calibration
- Data available as:
  - ASCII
  - KMZ
  - TIFF
- Exercise on this tool in upcoming session



Northern California Fires, 2015

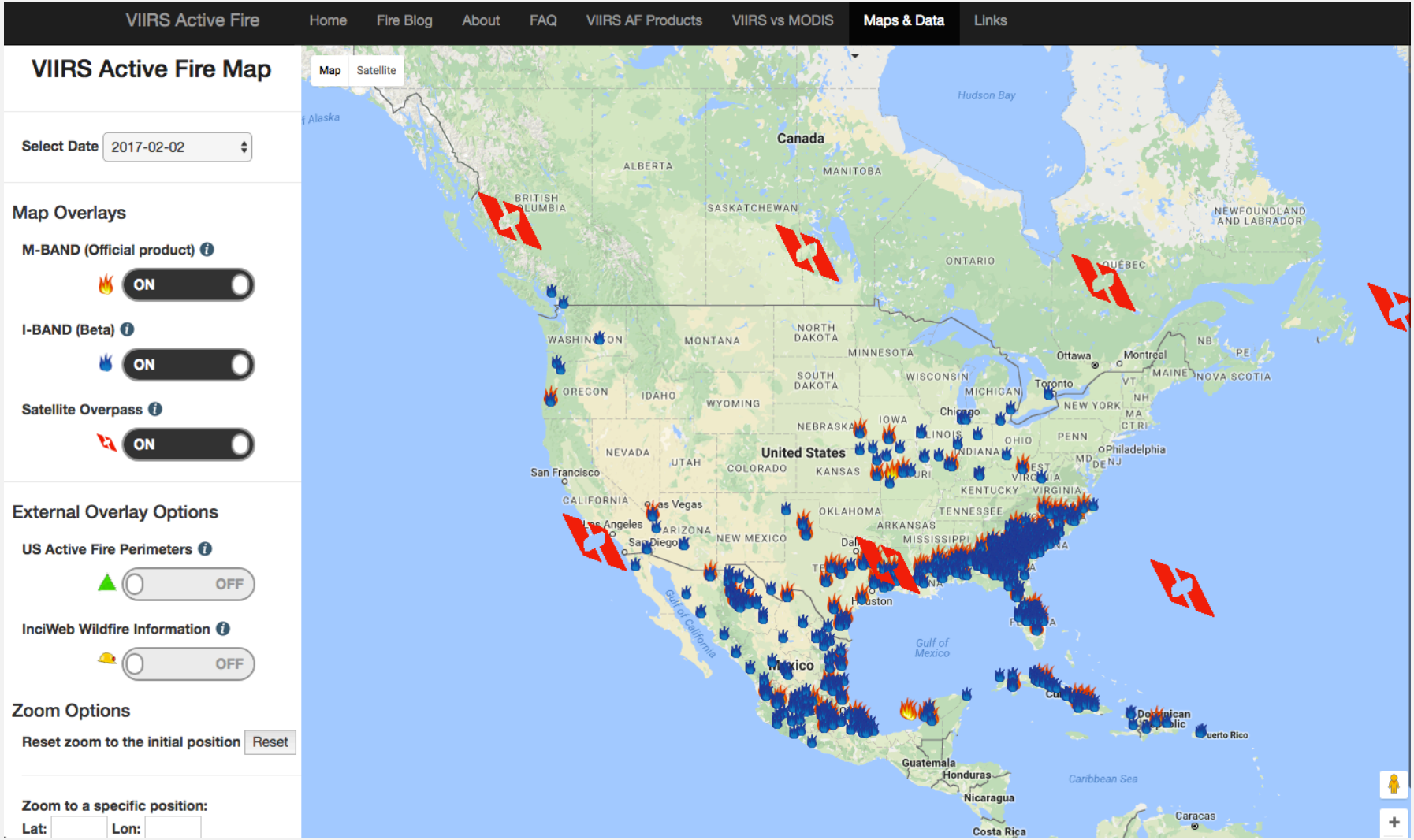
VIIRS Active Fire Map (CONUS)

http://viirsfire.geog.umd.edu/map/viirsMap.php



VIIRS Active Fire Map (CONUS)

http://viirsfire.geog.umd.edu/map/map_v2.php

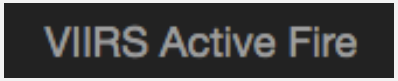


US Forest Service - Tools

https://fsapps.nwcg.gov/afm/

Where to Obtain VIIRS Land Products

Worldview:
http://worldview.earthdata.nasa.gov



VIIRS Active Fire:
http://viirsfire.geog.umd.edu/pages/about.php

NOAA Comprehensive Large Array-Data Stewardship System (CLASS):
http://www.class.ngdc.noaa.gov/saa/products/welcome

Level-1 and Atmosphere Archive & Distribution System Website: http://ladsweb.nascom.nasa.gov

Questions & Discussion Prompts

- Changes in what retrieved quantity are used to detect fires?
- What is a source of uncertainty for fire detection?

Questions